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CONTENT ANALYSIS CHLORINE TO RATE BACTERIA ON WATER KEN VILLA SWIMMING POOL BERASTAGI

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ABSTRACT

This research aims to analyze the relationship between chlorine levels and bacteria levels in pool water. Swimming pools are a recreational facility that many people are interested in, but if they are not managed properly, they can become a source of disease spread through contaminated water. Chlorine is used as a disinfectant to kill bacteria and microorganisms in pool water. The research method used was direct observation in several swimming pools, as well as taking water samples for testing in the laboratory. The parameters measured are chlorine levels and the number of bacterial colonies in the pool water. The data obtained was then analyzed to determine the correlation between chlorine levels and bacteria levels. The results showed that there was a significant relationship between chlorine levels and bacteria levels in pool water. The higher the chlorine level, the lower the number of bacterial colonies found. However, chlorine levels that are too high can also cause irritation to pool users. Therefore, it is necessary to regulate optimal chlorine levels to maintain pool water quality and user health.
Key Words: pool water, chlorine levels, bacteria levels, disinfectant

ABSTRAK

Penelitian ini bertujuan untuk menganalisis hubungan antara kadar klor dengan kadar bakteri pada air kolam. Kolam renang merupakan sarana rekreasi yang banyak diminati masyarakat, namun jika tidak dikelola dengan baik dapat menjadi sumber penyebaran penyakit melalui air yang terkontaminasi. Klor digunakan sebagai bahan disinfektan untuk membunuh bakteri dan mikroorganisme dalam air kolam. Metode penelitian yang digunakan adalah observasi langsung di beberapa kolam renang, serta pengambilan sampel air untuk diuji di laboratorium. Parameter yang diukur adalah kadar klor dan jumlah koloni bakteri dalam air kolam. Data yang diperoleh kemudian dianalisis untuk mengetahui korelasi antara kadar klor dan kadar bakteri. Hasil penelitian menunjukkan bahwa terdapat hubungan yang signifikan antara kadar klor dan kadar bakteri pada air kolam. Semakin tinggi kadar klor, semakin rendah jumlah koloni bakteri yang ditemukan. Namun, kadar klor yang terlalu tinggi juga dapat menyebabkan iritasi pada pengguna kolam. Oleh karena itu, diperlukan pengaturan kadar klor yang optimal untuk menjaga kualitas air kolam dan kesehatan pengguna.
Kata Kunci: air kolam, kadar klor, kadar bakteri, disinfektan

1. INTRODUCTION

Swimming pools are a recreational facility that many people are interested in, both for sports, entertainment and health therapy purposes. However, if swimming pool management is not done

properly, pool water can become a medium for spreading disease. Contamination of pool water by bacteria, viruses and other microorganisms can cause various health problems for users, such as skin infections, respiratory tract infections and digestive disorders.

One way to maintain the quality of pool water is by adding disinfectant substances, such as chlorine. Chlorine functions to kill bacteria, viruses and other microorganisms that can pollute pool water. However, improper use of chlorine can cause other problems, such as skin and eye irritation in pool users.

Therefore, this study aims to analyze the relationship between chlorine levels and bacteria levels in swimming pool water. It is hoped that the results of this research will provide important information for swimming pool managers in managing chlorine use optimally to maintain water quality and user health. Water borne disease is disease which caused by microorganisms like bacteria, virus and mold which swallowed through water which contaminated or touch with dirt. A number of microorganisms which including in disease water borne disease like Escherichia coli, Salmonella, Giardia, Shigella, Hepatitis A, pharyngo conjunctivitis by adenovirus (Cita and Adriyani, 2013; Lifewater, 2019). Water pool swimming is one between source water which can become receptacle transmission transmission disease between person. Screening which limited on person which use the pool for swim become wrong one factor which can increase deposit germs, which on turn increase risk infection germs on para user pool. Germ's agent disease which there is in pool swimming can enter through variety mechanism like system digestion, infect skin and eye (water *washed mechanisms*). A number of diseases which often infected through pool swimming like disease mold, otitis, conjunctivitis and meningoencephalitis amoeba (Rasti *et al.*, 2012).

Control spread disease *water borne disease* required effort which serious and sustainable. Between efforts practical which done as action preventive disease transmission is guard hygiene water in accordance limit quality standard which set government. Quality standard parameter biology environment water pool swimming covers bacteria *E coli, heterotropic plates count, Pseudomonas aeruginosa, Staphylococcus aureus* and *Leginolla sp*. Standard practice quality maximum of each <1 CFU/100 ml, 100 CFU/100 ml, < 1CFU/100 ml, < 100 CFU/100 ml and <1 CFU/100 ml (Permenkes, 2017). Wrong one effort which done for reduce population microorganism's pathogen in water pool swimming with use system chlorination. Compound derivative chlorine used as disinfectant pool swimming which can kill bacteria, mold, virus, and endospores. Substance chlorine like chlorine which used as disinfection can damage wall cell bacteria, structure proteins (including proteins membrane), sour nucleic, coat spores, and capsid virus at a time can clear up water (Herawati and Yuntarso, 2017; Kursani E, Yulianto B, 2019). Use chlorine in control microorganisms' water common done. However, in limit case certain remainder chlorine give rise to problem pollution material chemistry in body water pool swimming. Ken Villa in Berastagi which often usedby visitors for swim. Based on survey Which done there is 2 pools at Ken Villa that use chlorine. From two location pool theThe water comes from fresh water from drilled wells. The two pools at Ken Villa use chlorine according to the water flow used. Wrong One contaminant Which potential on pool swimming the is bacteria coliform. Bacteria coliform This is group bacteria pathogen Which often made as indicator biology something body water contaminated with dirt. Pool swimming Ken Villahave average visitors 35 per month, giving rate chlorine range 5 mg/liter. Pool swimming Fu with average visitors 35 person/month and giving rate chlorine range 0.2-0.5 mg/liter water pool swimming. Pool swimming Ken Villa 2 average visitors 40 person/month and giving rate chlorine range 0.1 mg/liter water pool swimming. Based on background behind the, writer interested for do study quality bacteria coliform on pool swimming which has experience disinfection compound chlorine. Study This in a way Specific intended for compare residue compound chlorine in water pool swimming and amount population bacteria coliform with standard standard quality quality chemistry and biology pool swimming based on Minister of Health Regulation No. 32 Year 2017 as well as observe connection rate chlorine with population bacteria coliform.

2. DATA AND METHODS

Study This is study descriptive with design cross sectional. Sample water pool swimming obtained of two pool swimming which there is in Ken Villa Berastagi. Observation rate chlorine water pool swimming use method spectrophotometry. Inspection population bacteria coliform use method Most Probable Numbers (MPN). Most method MPN use variety 555 Which consists from test estimation use medium Lactose Broth (LB) and test affirmation done with move culture positive from tube Lactose Broth (LB), with use ose from every tube to in tube media Brilliant Green Lactose Broth (BGLB) which containing tube Durham backwards (Kurniawan FB, 2018). Rate chlorine and coliform which there is on water pool swimming, compared to with Minister of Health Regulation No. 32 Year 2017.

3. RESULTS AND DISCUSSION

Pool swimmingKen Villa 1sourced from waterBoreholes, own timetable cleaning every day Friday, with pengunjung35per month, giving rate chlorine range 5 mg/liter. Pool Ken Villa 2 swimming pool sourced from eye water mountains with average visitors 40 person/month timetable cleaning a week very on day Saturday and day Sunday in fill return as well as giving rate chlorine range 0.2-0.5 mg/liter water pool swimming. Pool swimming Aj sourced from eye water mountains with average visitors 60 person/day and cleaning done every day Sunday and giving rate chlorine range 0.1 mg/liter water pool swimming. Results Inspection rate chlorine on three pool swimming Which there is in city Jayapura can seen on Table 1.

Table 1. Results of checking the chlorine levels of the Ken Villa Berastagi swimming pool

No	Swimming Pool	Chlorine Level (mg/l)	Quality Standard (Ministry of Health Regulation No. 32 of 2017)	Conformity
1	Wa	0.60		MS
2	Fu	0.13	1 – 1.5 mg/l	MS
3	Aj	0.13		MS

Information: TMS = No Fulfil Condition; MS = Meets Condition

From Table 1 above, it shows that the Ken Villa pool has chlorine levels that meet the standards of Minister of Health No. 32 Year 2017 And pool swimming Wow own rate chlorine exceed standard quality. Results inspection population bacteriaThe Ken Villa Berastagi City swimming pool can be seen in table 2 below.

Table 2. Results of coliform bacteria population examination in Ken Villa Berastagi swimming pools

Swimming Pool	Examination Results		Quality Standard	Conformity
	MPN Value of Coliform	MPN Value of Fecal Coliform		
Ken Villa	36	15	<1 CFU/100 ml (Ministry of Health Regulation No. 32 of 2017)	MS

Information: TMS = No Fulfil Condition; MS = Meets Condition

Results study obtained mark MPN on water pool swimming Wa coliform as much > 0/100 ml and coliform fecal as much 0/100 ml. Pool swimming Ken Villa coliform as much 91/100 ml and coliformfecal as much 23/100 ml. Pool swimming Ken Villa 2 coliform as much >1100/100 ml and coliform fecal as much 23/100 ml. Based on standard standard quality Minister of Health Regulation No. 32 Year 2017, Pool Ken Villa swimming 1 fulfil standard standard quality whereas pool swimming Ken Villa 2 and Ken Villa 2 No fulfil standard standard quality population bacteria *E. coli*.

Pool swimming become receptacle spread disease through water. Microorganisms in pool swimming can originate from contamination dirt Which originate from people Which use pool swimming. Microorganisms Which deposited in pool can form bacteria, mold, virus, worm, And protozoa. Pool swimming Also can become breeding a number of vector mosquito Which on turn can cause variety disease like filariasis, malaria, And fever bloody. Disinfection pool swimming very important for disable

various type pathogen (Chowdhury, Alhooshani and Karanfil, 2014). Chlorine is compound disinfectant Which commonly used for control microorganism's pathogen on water including water pool swimming. Treatment chlorine on water Also intended for change quality water become clear. Chlorine and its derivatives very effective kill various bacteria pathogen reason disease like *E. coli, Salmonella, Shigella* and *Vibrio* Which allegedly deposited in pool swimming. However, amount chlorine which tall on water can nature toxic (Between, Suyasa and Son, 2008). Pool swimming Wow own rate chlorine which exceeds threshold limit standard standard ideal content chlorine in water pool swimming. Pool swimming Fu and Aj own rate chlorine Which in accordance with standard quality. Rate chlorine Which exceeds limit standard quality water pool can cause effect side for Which dangerous for man like allergy and asthma, irritation skin and eye and Sick stomach.

Chlorine disinfectant which consists from 70% form chlorine. Process disinfection chlorine or calcium hypochlorite can with work with fast kill microorganisms which There is in water pool swimming. Chlorine in pool swimming Also can reduce content ammonia (Supriyadi, 2010). Chlorine can compound with organohalogens like trihalomethane, big content chlorine in water so enlarge opportunity happen rental with trihalomethane. Compound trihalomethane can cause cancer. Use chlorine can cause impact which dangerous for man like raise rate cholesterol and trigger happen cancer urinary (Setiawan, 2013). Bacteria *E. coli* is bacteria pathogen group coliform. Existence bacteria *E. coli* on body water, including in water pool swimming is indicator strong exists contamination fecal to body water. Bacteria *E. coli* is flora normal in body man, nature opportunistic. Bacteria pathogen *E. coli* consists on enterotoxigenic *E. coli* (ETEC), enteroinvasive E. coli (EIEC), enteropathogenic *E. coli* (EPEC), enterohemorrhagic *E. coli* (EHEC) And enteroaggregative *E. coli* (EAEC). Generally, infection Serious bacteria *E. coli* can cause diarrhea (Prasiddhanti, 2015). Study content coliform on pool swimming in City Jayapura show exists contamination bacteria coliform fecal and non fecal. Population group bacteria the No fulfil standard standard quality in accordance with Minister of Health Regulation No. 32 Year 2017. Contamination bacteria coliform fecal general found in pool rennag. Study which done by Rasti find exists contamination bacteria coliform (Rasti *et al.*, 2012). Studies other bacteria coliform Also found on pool swimming (Talita, Nurjazuli and Dangiran, 2016; Suriaman and Apriliasari, 2017).

Contamination bacteria coliform and coliform fecal in pool this allegedly originate from contamination dirt animal, visitors pool swimming and ingredients which contaminated. Visitors pool swimming usually no there is screening special related cleanliness. Contamination can originate from user pool swimming which throw away saliva, skin and also can originate from process excretion man form urine or feces. Content coliform taller compared to with coliform fecal. His height bacteria coliform caused by circumstances pool which open which possible bacteria coliform can originate from animal and wind which fly ingredients which contaminated with bacteria coliform which furthermore touched with water pool.

His height contamination bacteria coliform this can increase opportunity user pool swimming can infected with bacteria this. The taller population microorganisms on pool swimming so the taller also opportunity user pool swimming infected with bacteria pathogen. However, interaction pathogen with hosts no always tangible disease. Being connection host and germs pathogen determined by balance between virulence germs and power stand host (Suharto, 1994). Content chlorine which there is on pool swimming in a way descriptive found exists correlation positive to amount bacteria coliform. The taller rate chlorine which there is in water pool swimming the lower amount population bacteria coliform and coliform fecal. Connection negative between amount chlorine and MPN bacteria coliform on pool swimming Fu and Aj proper allegedly caused small amount sampling which used every pool which only one sample one pool swimming.

Level cleanliness water pool swimming from third pool swimming influenced by, amount timetable cleaning pool where the more often cleaned the cleaner water pool swimming, amount visitors the more lots amount visitors so the bigger risk contamination and rate chlorine which given in mg/liter water the bigger rate chlorine which given the smaller contamination amount bacteria *E. coli*. Results study mark MPN on water pool swimming Wa coliform as much > 0/100 ml and coliform fecal as much 0/100 ml can influenced by rate chlorine which tall on water pool swimming. The bigger rate chlorine so the lower

amount bacteria coliform and coliform fecal. However, addition chlorine must in accordance with standard quality which has set by government based on Minister of Health Regulation No. 32 Year 2017.

4. CONCLUSION

Rate Chlorine Pool swimming Ken Villa 2 relatively tall compared to with standard standard quality water swimming based on Minister of Health Regulation N0. 32 Year 2017. Quantity rate chlorine Which low make pool swimming Ken Villa 1 And Ken Villa 2 own mark number germs Which tall, which on turn No fulfil standard standard quality germs on pool swimming. Manager pool swimming need notice quality pool swimming, with Keep going do evaluation rate chemistry and rate biology pool swimming in accordance with standard standard quality water pool swimming.

5. OFFICIAL STATEMENT

6. REFERENCE

Antara, I. K. G., Suyasa, I. W. B., & Putra, A. A. B. (2008). Kajian kapasitas dan efektivitas resin penukar anion untuk mengikat klor dan aplikasinya pada air. *Laboratorium Penelitian Jurusan Kimia FMIPA Universitas Udayana, Bukit Jimbaran*, *Jurnal Kimia, 2*(2), 87–92.

Chowdhury, S., Alhooshani, K., & Karanfil, T. (2014). Disinfection byproducts in swimming pool: occurrences, implications and future needs. *Water Research, 53*, 68–109.

Cita, D. W., & Adriyani, R. (2013). Kualitas air dan keluhan kesehatan pengguna kolam renang di Sidoarjo. *Jurnal Kesehatan Lingkungan, 7*(1), 26–31.

Herawati, D., & Yuntarso, A. (2017). Penentuan dosis kaporit sebagai desinfektan dalam menyisihkan konsentrasi ammonium pada air kolam renang. *Jurnal SainHealth, 1*(2), 66. https://doi.org/10.51804/jsh.v1i2.106.66-74

Kurniawan, F. B., & I. T. S. (2018). *Bakteriologi Praktikum Teknologi Laboratorium Medik*.

Kursani, E., Yulianto, B., & R. A. R. (2019). Analisis kadar sisa klorin dan pH air di kolam renang umum kota Pekanbaru. *Jurnal Kesehatan Al-Irsyad, XII*(2), 11–22.

L. Prasiddhanti, A. E. T. H. W. (2015). Karakter permukaan *Escherichia coli* yang diisolasi dari susu kambing peranakan Ettawah yang berperan terhadap kemampuan adesi pada sel epitelium ambing. *Jurnal Sain Veteriner, 33*(1), 29–41.

Lifewater. (2019). 7 Most Common Waterborne Diseases (and How to Prevent Them). Available at: https://lifewater.org/blog/7-most-common-waterborne-diseases-and-how-to-prevent-them/ (Accessed: June 8, 2022).

Permenkes. (2017). *Standar Baku Mutu Kesehatan Lingkungan dan Persyaratan Kesehatan Air untuk Keperluan Higiene Sanitasi, Kolam Renang, Solus Per Aqua, dan Pemandian Umum*. Indonesia.

Rasti, S., et al. (2012). Assessment of microbial contamination and physicochemical condition of public swimming pools in Kashan, Iran.

Setiawan, D., Sibarani, J., & Suprihatin, I. (2013). Perbandingan efektifitas disinfektan kaporit, hidrogen peroksida, dan pereaksi Fenton (H2O2/Fe2+). *Cakra Kimia, 1*(2), 16–24.

Suharto. (1994). Flora normal serta hubungan kuman dengan hospes dan lingkungannya. In *Mikrobiologi Kedokteran* (revisi). Jakarta.

Supriyadi, Sumantri, I., & Hartati, I. (2010). Pengaruh dosis klorin pada pertumbuhan bakteri coliform total dan *Escherichia coli* pada Sungai Kreo, Sungai Garang dan Sungai Tugu Suharto. *Banlit Fakultas Teknik-Universitas Wahid Hasyim Semarang, 12*(1), 30–35.

Suriaman, E., & Apriliasari, W. P. (2017). Uji MPN coliform dan identifikasi fungi patogen pada air kolam renang di Kota Malang. *Jurnal SainHealth, 1*(1), 15–22.

Talita, S., Nurjazuli, & Dangiran, H. L. (2016). Studi kualitas bakteriologis air kolam renang. *Jurnal Kesehatan Masyarakat (e-Journal), 4*(1), 196–203.